

any badly tuned piano, differing probably from performer to performer, and, as shown by the above comparison, often out by a quarter of a Tone.

Mr. Ellis's conclusion was that there is not anything approaching to a single "natural" music scale. That, on the contrary, the systems, where systems can be said to exist, are very diverse, and often very capricious, and are always very imperfectly carried out. This arises probably from harmony proper being unknown, though *ensemble* playing is common. In the latter case unisons are the rule, the effect being produced by diversity of quality of tone; but certain effects are produced by admitting Octaves, and rarely Fourths and Fifths—no more. Also a kind of polyphony may be remarked, some instruments, especially those with tones of very short duration, being allowed to *discant* while the others go on with the air.

On the whole, Mr. Ellis considers his work has only commenced an investigation which will have to be pursued for many years, principally by physicists with a slight knowledge of music, not by European musicians, whose thoughts are biassed by the system of music in which they are accustomed to think.

NOTES

THE Anniversary Meeting of the Chemical Society will be held on Monday, March 30.

THE Mercers' Company have made a contribution of 52*l.* 10*s.* to the fund on behalf of the family of the late Henry Watts, F.R.S.

WE are glad to see from the recent letter of Sir Spencer Robinson, in the *Times*, that the Admiralty are at last taking to experiment to decide the question as to the best form of war-ship. This is as it should be, and we hope the Admiralty will continue their experiments until they have obtained a solid scientific principle to guide them.

OUR readers may be interested in the following remarkable and well-authenticated instance of the effect of atmospheric influences in varying the distance at which lights are visible at night, communicated to us by a correspondent. The paragraph is taken from the *Aberdeen Journal* of March 21. The steamship referred to was on her weekly voyage from London to Aberdeen, being one of a well-known line of passenger steamers trading within these ports. "*Singular Phenomenon*.—Capt. Marchant, of the s.s. *City of Aberdeen*, reports that owing to the peculiar condition of the atmosphere yesterday morning he saw, quite clear and bright, the Girdleness Light (Aberdeen Bay) at 1 a.m., when his vessel was a little to the south of Montrose, a distance of over thirty-six miles, and when two miles north of Stonehaven he could distinctly see the Buchanness Light (about twenty miles north of Aberdeen and three miles south of Peterhead), at a distance of fully thirty-two miles. The lights are laid down on the Admiralty chart as visible at nineteen and seventeen miles respectively."

THE half-yearly general meeting of the Scottish Meteorological Society was held on March 23. The business before the meeting was:—Report from the Council of the Society; Report of the work of the Scottish Marine Station, by the Scientific Staff of the Station; Anemometrical observations at Dundee, by David Cunningham, C.E., Harbour Chambers, Dundee; Diagram to facilitate hygrometric calculations, by David Cunningham, C.E.; Formation of snow crystals from fog, by R. T. Omond, Superintendent of Ben Nevis Observatory; Meteorology of Ben Nevis, to February 1885, by Alexander Buchan, Secretary.

A TELEGRAM from Fort William reports that the Rev. John M'Kintosh, Free Church minister, and Mr. Colin Livingstone, of Fort William, made the ascent of Ben Nevis on Monday. The weather was fine, but, owing to the quantity of snow on the higher part of the mountain, footing in some parts was obtained with considerable difficulty. This was particularly the case for about 1200 feet above the Red Burn, and crossing steps had frequently to be cut in the frozen snow. The occupants of the observatory at the top of Ben Nevis were found in excellent health and spirits. The buildings, with the exception of the chimneys and tower, are buried in the snow, access to the rooms being obtained through the tower by means of a ladder. But, once reached, the rooms are very comfortable. The junior assistant was found amusing himself with a kind of raft, which was carried over the snow by means of a sail.

AT a special meeting of the Institution of Mechanical Engineers, held on the 20th inst., was read, amongst other papers, one by Mr. R. Heenan on the Tower spherical engine. As its name betokens, it consists of a system of parts contained within a sphere, so united as to enable them under the action of steam pressure to impart rotatory motion to a shaft. Considered kinematically, the three elementary moving parts of which the engine is composed are: a pair of quarter spheres, having a circular disk of the same diameter as the sphere interposed between them. The straight edges of the spherical sectors are hinged on opposite sides of the disks along diameters at right angles to each other. Each sector rotates upon an axis of its own, upon which it is fixed symmetrically; these two axes lie in the same plane, meeting in the centre of the disk at an angle of 135°. The two sectors thus correspond with the two bows of an ordinary universal joint, the disks replacing the crosspiece connecting the bows. Throughout each revolution there are consequently two cavities simultaneously in process of opening and two others in process of closing, all four alike changing at the same mean rate of increase and diminution. If, therefore, the disk with its pair of sectors be encased within a hollow sphere of the same diameter, and, if steam be admitted into the two opening cavities, and exhausted from the two that are closing, continuous rotatory motion will be produced, driving the two shafts represented by the axes of the two sectors. When one of the two opening chambers is only just commencing to open, the other is half open; so that, while the one is making no effort, the other is in the position of best effort. Although the whole of the engine may be said to be contained within the sphere, it is an interesting feature in the system that the capacity of the engine is no other than the full capacity of the sphere itself, inasmuch as four quarters of the sphere are filled and emptied in one revolution. The Tower spherical engines have been used for the electric lighting of trains on the Great Eastern Railway; they have continued running since October 26, 1884, with perfectly satisfactory results. The engine is coupled directly to a dynamo specially made, the two being together on one bed-plate. The whole is mounted on the top of the locomotive-boiler behind the dome, so that it occupies no space on the foot-plate, and the steam can be taken direct from the dome. The construction of the engine was illustrated by means of twenty-six diagrams.

WE have received the Report of the City and Guilds of London Institute for Technical Education for the past year.

M. ALBERT GAUDRY, Professor of Palæontology in the Museum of Natural History, has reproduced as a pamphlet a note read by him before the Academy of Sciences on the new gallery of Palæontology added to the Paris Natural History Museum. This is a provisional gallery for the large skeletons of fossil animals; but M. Gaudry has the vision of a far more perfect and elaborate gallery before his eyes. The new gallery,

he says, in concluding his description of its contents, is far from being sufficient. What is needed is a museum where the fossils could be classified, epoch by epoch, and where it would be easy to follow the history of the development of life from the time at which traces of it are perceptible down to the coming of man. "We may hope that one day France, where Cuvier founded the science of fossils, shall have a palaeontological museum worthy of her. Meanwhile the new gallery will render a service, for it will give some idea of the majesty of ancient nature."

THE Electrical Exhibition held at the Observatory of Paris was opened by the President of the Republic on the 21st inst. The Ministers of Postal Telegraphy and Public Instruction were present. A Gramme machine was used for rotating the large dome on the roof of the establishment; the rotation of the dome was made visible at a distance by a ray of electric light sent through the aperture. Transmission of force to a distance was shown by setting into operation a printing machine. A series of lectures is being delivered on the several topics relating to electricity in a room fitted up for the purpose. The first is by M. Wolf, on the Application of Electricity to Astronomy, and the last by M. Marié-Davy, on the Use of Electricity in Prognosticating the Weather. All these lectures will be taken down by shorthand writers and published.

THE *Meteorologische Zeitschrift* for February contains a notice by Dr. Eschenhagen on the effect of the Spanish earthquake of Christmas Day last on the magnetic registering apparatus at Wilhelmshaven. During 1883 neither the earthquake of Ischia nor the Krakatoa catastrophe had any influence whatever on the instruments at that place, while an investigation of the curves of the magnetograph during the Andalusian shocks gave the following results. Of the three instruments employed for measuring magnetic variations, only one, that for the vertical intensity, showed any perceptible change at the time of the shock. The curve for horizontal intensity was broken at that point by an unfortunate accident: the declination instrument marked complete rest, but there was a movement of the unifilar suspended magnet such as might be produced by a shock in the direction from south to north. The movement of the needle at the time of the earthquake had not the character of a magnetic disturbance, but was a simple swinging to and fro. The curve showed a gap at this point, for the rapid swinging could not be registered, until the motion became fainter. The first shock to the balance on December 25 was, with tolerable exactitude, 9h. 52m. Wilhelmshaven time, and ceased at 9h. 56m.; new shocks took place at 9h. 59m., 10h., 10h. 2m., and 10h. 5m. Dr. Eschenhagen does not doubt that the balance acted at this time as a kind of seismograph. Accurate observations as to the precise moment of the outbreak of the earthquake at its centre are not forthcoming; but according to the newspapers the first shock was felt at Madrid at 8h. 53m., Madrid time, while the same time is also given for Seville; we may therefore take this to be the time for the Sierra Nevada region, and the shock in Granada, which lay about the centre of the movement, would then be at 9h. 8m. Greenwich time. At Greenwich, however, it was registered at 9h. 15m. in a similar way to that at Wilhelmshaven. It reached the latter place at 9h. 19.4m. Greenwich time. The distance between London and Granada is about 1650 kilometers, but between Wilhelmshaven and Granada 2040 kilometers, and the wave would have taken 7 m. to traverse the former, and 11.4 m. the latter distance. This would give varying degrees of speed in propagation, and if we regard the difference of 390 kilometers as traversed in 4.4 m., we get a third rate of speed which, perhaps, proves that the speed lessens considerably with the distance. It should not be forgotten that Wilhelmshaven is surrounded by marshy ground, which might have retarded the progress of the shock. It

appears, too, that the general movement was not propagated in concentric circles.

A WRITER in a recent issue of the *North China Herald* describes a work on "The Mathematicians and Astronomers of China and Foreign Countries," compiled toward the close of the last century by a scholar who afterwards became Viceroy of Canton. It is in ten volumes and forty-six chapters, of which three only are devoted to foreign astronomers and mathematicians. Forty-one of these are mentioned, but a few foreigners are included in the chapters on the natives, for during the 4000 years which the history covers there has always been a leaking-in of knowledge, in spite of the isolation of China; and when foreign mathematicians were to be had, China has made use of them. The earliest Chinese astronomers recorded in this history were in the reign of Huang-Ti, and are purely legendary. One invented the cycle of sixty years, another the twelve musical tubes which constitute the basis of weights and measures. These are supposed to have lived in the twenty-seventh century before Christ, but, as they were not heard of until more than 2000 years later, one may assume almost any thing about them except that they lived at the date assigned to them. The first real astronomers whose names remain are the official astronomers of the Emperor Yao. The foundation of scientific astronomy was then laid in the intercalary month and in the use of an instrument for comparing the movements of the stars and the planets with those of the sun and moon. The next scientific triumph mentioned is the measurement of the width of the earth, which is stated to be 2,333,000 *li* 325 feet from east to west, and 2,335,000 *li* 225 feet from north to south. This statement is found in a certain "Shan Hai Ching," a very old but fabulous work. The Chinese take it as a proof that in ancient times latitude and longitude were understood, because it is said that the official measurer calculated with his right hand, and with his left pointed to the north side of a certain hill. An astronomer who lived in the eleventh century before Christ appears to have been in advance of the Greek mathematician, for it is recorded that he explained to his friend, a certain great sage, that the two sides of a right-angled triangle being taken as three and four, the hypotenuse will be five. The statement as given also embraces the squaring of the circle, "the square comes out of the round as earth comes out of heaven." This comes from an ancient work which is said to be the only one stating the principle that a round heaven rests on a flat earth. But the same book states that the earth is round, and that the length of the day and the variation of temperature depend on the latitude. The Emperor Kang Hsi, towards the close of the last century, pointed to the work here referred to as evidence that trigonometry certainly went from China to Western countries in ancient times. During the various dynasties that have ruled in China since our era, the number of astronomers whose labours are recorded have progressively increased, especially after the invention of printing. The forty European astronomers mentioned form a classified list, mainly of ancient Greeks and moderns. Ptolemy, Copernicus, and King Alphonso are placed side by side, and Tycho Brahe is closely followed by Archimedes and Napier. The translators of scientific books from among the Roman Catholic missionaries in China are in close proximity with Newton and Kepler. They won their position in the Chinese estimation amongst the great philosophers by their efforts as translators to teach the Chinese such facts and theories as they knew. The whole work shows that the Chinese honour men of scientific knowledge, and that a number of themselves are always ready to devote themselves with enthusiasm to the study of the mathematical sciences.

THE Royal Academy of Sciences of Belgium has issued a notice with reference to an extraordinary competition for the

year 1887. The Government has proposed, and the Chambers have adopted a law having for its object the preservation of fish and their restoration to the rivers. The main obstacle to this end is the pollution of the waters of small unnavigable streams by solid and liquid matter poured into them by various industries, which render them unfit for the breeding and existence of fish. The Academy, therefore, calls on science to aid the public authorities. One of its members has placed at its disposal the sum of three thousand francs, which it has decided to spend in giving a prize for a thorough study of the following questions, at once biological and chemical:—(1) What are the special substances in our principal industries which, when mingled with the water of small streams, render them incompatible with the existence of fish and unfit for the consumption of man and beast? (2) Investigation and indication of practical measures for purifying water as it leaves manufactories, so as to render it innocuous to fish without interfering with the industry, combining the expedients offered by decanting basins, filtering and chemical agents. (3) Separate experiments on the substances which in each special industry kill fish, and on the degree of resistance which each species of edible fish offers to this destruction. (4) A list of the rivers in Belgium which are actually depopulated by this state of things, with an indication of the special industries in these rivers, and a list of the edible fish which inhabited them before the establishment of the factories. If a memoir is judged satisfactory for the solution of the two first points, a prize of two thousand francs will be given, even though the two latter questions are untouched. Papers should be legibly written, and should be addressed to M. Liagre, Perpetual Secretary, au Palais des Académies, Brussels, before October 1, 1887. Quotations are to be made with great exactness, and authors should therefore mention the edition and page of works cited. A motto must be selected, and the names inclosed in a separate sealed envelope, with the motto superscribed. The papers sent in will remain in the archives of the Academy.

A RECENT issue of the *Peking Gazette* contains a report from the outgoing Viceroy of Fuhkien stating that he had handed over the insignia of office to his successor, including *inter alia* the seal, the imperial death warrant, banners and tablets, and the conch-shell best used by the Throne. The latter has a curious use. A conch-shell with a whorl turning to the right is supposed when blown to have the effect of stilling the waves (from the excruciating nature of the sound?), and is hence often bestowed by the Emperor upon high officers whose duties compel them to take voyages by sea. The Viceroy of Fuhkien probably possesses one of these shells in virtue of his jurisdiction over Formosa, to which periodical visits of inspection are supposed to be paid.

UNDER the title "A Prophetic Almanac a Hundred Years ago," *Science et Nature* describes, with illustrations, portion of one of a series of almanacs issued between 1789 and 1799, which has recently been presented to the Paris Bureau of Meteorology. The collection was made at the time by Guéneau Montbeillard, the colleague of Buffon, and the author of the section on birds in the latter's natural history. Montbeillard was also a meteorologist, and his observations, made at his chateau at Semur in Côte-d'Or, can be employed to check the prophecies made in the *Almanach fidèle* published annually at Troyes, "par les soins du sieur Maribas, grand astrologue et mathématicien." Selecting the page of the almanac for the month of March, 1785 (precisely a century ago), we find in the last column, in ordinary language, general predictions for the four quarters of the month. For example: "New moon on the 10th, at 10h. 38m. in the evening, in the sign Pisces. The weather will be fine, and the winds very troublesome." Next to this come four columns, filled with cabalistic signs and occupying the middle of the page. The last

of these gives for each day the position of the moon in one of the zodiacal signs. The first of the four indicates by a cross or a triangle whether the day is a festival or a working day. In the second column the nature of the weather which may be expected is marked by a succession of signs, the key to which is given in the first page, while the third, by a similar series of signs, indicates the nature of the operations for which the day in question is particularly favourable. Thus Sieur Maribas advises his clients that March 10th, 11th, and 28th, 1785, are favourable for hair-cutting; the 12th, 13th, and 27th for paring the nails; the 2nd, 14th, and 21st for blood-letting; but there was only one day, March 4, on which pills should be taken, while it would be unwise to wean infants on any day but the 18th. For wood-cutting, the 9th, 15th, or 16th should have been selected, and so on. The philosopher's weather predictions for the month appear to have been falsified in almost every instance. He foretold rain for seven days and snow for two; in fact it rained very slightly on three days, none of which were mentioned by him, and did not snow on his days at all. In temperature his luck was as bad, for the day which he foretold would be warm, was the coldest of the whole year. Besides, "the various changes of the air for each day produced by the stars on our horizon," Sieur Maribas promises in his title page, "several pretty sayings suitable for exhilarating and diverting curious and melancholic minds." Among these meteorological *gentillesces* are the following:—Women are cured of laziness by vanity or by love; To know a woman well, it is necessary to contradict her; Nothing grows old so soon as a benefit. The "grand astrologer and mathematician" evidently intended his "pretty sayings" chiefly for those of a melancholic turn of mind.

WE have received the *Proceedings* of the Holmesdale Natural History Club for the years 1881, 1882, and 1883. This club has its home at Reigate, and its papers, though mainly concerned with south and central Surrey, range over a great variety of natural history subjects. Among the principal papers in this number (which, it should be remarked, would be much improved by an index, or classified list of the papers) are:—The potato disease, by Mr. Gill; the hairs of plants as concerned in the supply of water and nourishment, by Dr. Bossey; ornithology in Wray Park, by Mr. Crosfield; the *Sprolegna ferox* (the fresh-water fish parasite), by Mr. Boyle; the habits of the stalk-eyed crustacea of the British Islands, by Mr. Lovett; and the marine life of the Reigate district, by Mr. Gilbert. All the excellent work of the Club appears to be done with an expenditure of from 30*l.* to 40*l.* per annum.

WE are asked to state that in the report of Sir William Thomson's Baltimore lectures, p. 296, in line 13 from the top of the page, and in the left hand members of equations (19) and (21), for " ω " and " ω_1 " read " ϖ " and " ϖ_1 " respectively.

THE additions to the Zoological Society's Gardens during the past week include a Malbrouck Monkey (*Cercopithecus cynosurus*) from South Africa, presented by Mr. W. E. Clift; a Grivet Monkey (*Cercopithecus griseo-viridis*) from South Africa, presented by Mr. W. Ockey; a Pine Marten (*Mustela martes*) from Ireland, presented by Mr. Frank Sharp; a Bar-breasted Finch (*Munia nisoria*) from Java, two St. Helena Seed-Eaters (*Cri-thagra butyracea*), a Grey-necked Serin Finch (*Serinus canicollis*), a Brown Canary Finch (*Serinus tottus*), two — Finches (*Serinus* —) from South Africa, presented by Mr. J. Abrahams; two Pheasants (*Phasianus colchicus*), British, deposited; a Stein-bok (*Nanotragus tragulus* ♀), four Wattled Starlings (*Dilophus carunculatus* ♂ ♂ ♀ ♀), two White-throated Seed-Eaters (*Cri-thagra albigularis* ♂ ♀), two Striated Colys (*Colius striatus*) from South Africa, two Brazilian Tanagers (*Ramphocelus brasilius*), two Green-headed Tanagers (*Catilliste tricolor*) from Brazil, purchased